ATTACHMENT 1

SPECIFICATION FOR REPLACING ETF A and C PLANT PROCESS AIR HEATER SAFETY SYSTEMS

PROJECT NUMBER 9943

ARNOLD ENGINEERING DEVELOPMENT CENTER
ARNOLD AIR FORCE BASE TN 37389

1. SCOPE

This specification establishes the performance, design, test, and acceptance requirements for replacing the Burner Management Systems and Gas Train components on the Engine Test Facility (ETF) A-Plant North, A-Plant South, and ETF C-Plant H1 Process Air heaters. This specification is also for the replacement of the pilot burners on the A-Plant North and South Heaters. Items to be replaced on the A-plant Heaters are UV flame detectors, burner management relays, ignition systems, burner valves, piping, natural gas flow control valves, and pilot valves. Items to be replaced on the C-plant heater are burner management relays, and pilot valves. The Engine Test Facility is located at Arnold Air Force Base, TN. and commonly referred to as Arnold Engineering and Development Center (AEDC). The heaters condition process air used for testing turbine fan engines in high altitude test cells that simulate flight conditions. The A-Plant North and South heaters provides heated air to the ETF-T and J test cells and uses natural gas for both the pilots and main burners. The C-Plant H1 heater provides heated air to the ETF-C1 and C2 test cells and uses natural gas for the pilots only. The main burners use commingled fuel from the Bulk Fuel Farm that is located on base. Shop air is used to atomize the commingled fuel to the main burner. The Burner Management System on these heaters is being replaced because replacement parts are no longer manufactured and because the present units do not meet codes, and AEDC Safety Standards.

2. APPLICABLE DOCUMENTS

2.1. The following documents listed below form a part of this specification to the extent specified herein.

2.1.1. AEDC Drawings

RU623283.01, Rev. C	Natural Gas Schematic for North Heater
RU623283.02, Rev. B	Natural Gas Schematic for South Heater
RF631232.01, Rev. A & Rev. B	Natural Gas Schematic for Heater H1
RF631239.01, Rev. A	Commingle Fuel & Shop Air Schematic for Heater H1
A-3426	Natural Airfoil Burner Co. Burners for North and South Heaters

A-2171 Natural Airfoil Burner Co. Burners for North and South Heaters

RJA-0-1.2 Piping Diagram for Continuous Heater Fuel & Steam

RF531574.07 H1 Heater PLC Interconnect Diagram, C-Plant

RU531717.04 PLC Interconnect Diagram, A-Plant Heaters

2.1.2. AEDC Standards

CONTRACTOR C, GUIDE FOR CLEANING MANUAL, 354.1

2.1.3. AEDC Safety, Heath, and Environmental Standards

A6 User & Subcontractor Safety

Supplement 1 to Standard A6 - Outside Construction Contractor Safety Program

B1 Work Clearances

B2 Lockout Tagout-LOTO

B4 Electrical Safety

C5 Welding and Cutting

D3 Identification of Piping Systems

E19 Lead and Heavy Metals

F9 Head Protection

F10 Foot Protection

2.1.4. Codes and Standards

a. AMERICAN SOCIETY OF MECHANICAL ENGINEERS

b. ASME/ANSI B16.5 PIPE FLANGES AND FLANGED FITTINGS

c, AMERICAN SOCIETY OF MECHANICAL ENGINEERS

d. ASME B31.3 PROCESS PIPING

e. NATIONAL FIRE PROTECTION AGENCY (NFPA)

f. NFPA-54 NATIONAL FUEL GAS CODE

g. NFPA-70 NATIONAL ELECTRIC CODE

h. NFPA-86 STANDARD FOR OVENS AND FURNACES

i. AMERICAN PETROLEUM INSTITUTE

j. API Practice 573

k. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

2.2. Order of Precedence. In the event of a conflict between the text of this document and the references cited herein the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1. Systems Description

3.1.1. A-Plant North and South Heater Description

Each A-Plant process air heater has the capacity to heat 250 pounds of air per second from 100 deg F to 800 deg F. The duty capacity for each heater is 300 million BTU/HR. The process air enters each heater near the top through a 72 inch-diameter T-shaped header. Two hundred 3.5 inch-diameter tubes fan out from the vertical section of the inlet header and run down the inner wall of the combustion chamber. The tubes then connect to another 72 inch-diameter header at the bottom of the heater through which the heated air exits the heater. Below the combustion chamber is the burner section. Each heater has ten main burners in a circular configuration. Each burner is rated at 30 million BTU/HR heating capacity using natural gas for fuel. Two combustion air fans are

connected to the burner section. Natural gas is supplied from the A-Plant Natural Gas System located on Third Street in front of the A-Plant Refrigeration Building. The normal 90 psig gas pressure is reduced to 30 psig by a pressure regulator located upstream of both heaters. The pilot gas system is further reduced to 10-15 psig.

3.1.2. C-Plant H1 Heater Description

The C-Plant process air heater is a radiant, vertical fired type heater with the capacity to heat 100 (min) to 1100 (max) pounds of air per second up to 850 deg F. H1 heater is made up of two independent banks. Process air enters the heater at the top through a 48 inch-diameter header. One hundred and four (104 per side) 4 inch-diameter tubes run perpendicular from one inlet header down the inner wall of the combustion chamber and then connect to another 48 inch-diameter header at the bottom of the heater through which the heated air exits the heater. Each bank has two supply and return headers. Each header has 104 vertical tubes for a total of 208 per bank. Below the combustion chamber is the burner section. Each bank has 12 main burners in a parallel configuration to the headers. Each burner is rated at 42 million BTU/Hr heating capacity using commingle fuel oil, so each bank has an output of 504 million BTU/Hr. Atomized air is used to vaporize the fuel oil. One combustion air fan per bank supplies air to the burner section. Natural gas is supplied to the heater for pilot gas only at 82 psig and reduced down to 16 psig at each pilot burner. The main burners are supplied with commingle fuel oil from the bulk storage tanks. Commingle fuel is supplied at 138 gpm to the heater at 90 psig then reduced down to 5 – 35 psig for each burner. The atomized air must be maintained at 10 – 25 psig above the commingle fuel pressure. The commingled fuel is a possible mixture of kerosene, diesel, JP4, JP5, and JP8 at –20 to 110 degrees F.

3.2. Preliminary and Critical Design Reviews

The contractor shall support a Preliminary Design Review (PDR) at 25% design completion and a Critical Design Review (CDR) at 95% design completion at the contractor's facility. The contactor shall schedule these reviews and notify the government two weeks prior to the review so that attendance from AEDC can be arranged. With the notification for each review the contractor shall submit design calculations and drawings, which

supports his design approach. This information will be reviewed and commented on at the design reviews.

3.2.1 As a minimum, the PDR shall consist of:

3.2.1.1 Calculations and supporting documentation verifying conceptual design does not impair overall heater performance.

3.2.1.2 Conceptual design drawings showing interfaces to existing plant equipment.

3.2.1.3 Area classification maps showing the electrical hazardous area below and around the North, South, and H1 Heaters. Hazardous areas shall be identified per the National Electric Code (NEC) Section 500.

3.2.1.4 Calibration and Measurement Requirements Summary (CMRS) with proposed manufacture and model numbers of instruments, specifications, and applicable calibration procedures (see attached form in Appendix F).

3.2.1.5 Identification of long lead items.

3.2.1.6 Approved construction plan and schedule.

3.2.2 As a minimum, the CDR shall consist of:

3.2.2.1 Detailed drawings showing piping layouts, detail piping, electrical and instrument conduit layout and detail connections from the field devices to the interface panels.

3.2.2.2 Resolution of deficiencies from preceding reviews.

3.3. Demolition Requirements

3.3.1. A Plant North and South Heaters

3.3.1.1. Remove all abandoned steam and condensate piping and components as indicated on attached photographs and marked up drawing number RJA-0-1.1. These lines have already been disconnected.

3.3.1.2. Remove all abandoned fuel oil piping and components per marked up drawing number RJA-0-1.1.

3.3.1.3. Remove all abandoned propane piping and components. per marked up drawing number RJA-0-1.1.

3.3.1.4 Remove all existing electrical wiring and conduit that will be displaced by new electrical wiring and conduit.

3.3.1.5 Remove all existing burner management system components including burner relays and programmable logic controller (South Heater only) and wiring connected to the existing field termination and I/O cabinets located in the heater building (Building 855). Reference marked up drawing number RU531717.04 and pictures in Appendix A.

3.3.1.6 All material removed shall be taken to the AEDC salvage yard, which is located within two miles of the work site. All items with bar codes shall be turned over the job contact.

3.3.2. C-Plant Heater H1

3.3.2.1 Remove all abandoned natural gas system piping and pipe components from blinds located at pipe racks upstream of valves PCV.H1XX.25A, PCV.H1XX. 25B, PCV.H2XX.25A, and PCV.H2XX.25B to each burner and blind each burner. See marked up drawing number RF631232.01, Rev. “0”.

3.3.2.2 Remove all existing electrical wiring and conduit that will be displaced by new electrical wiring and conduit.

3.3.2.3 Remove all existing burner management system components and wiring connected to the existing field termination and I/O cabinet located in H1 heater building (Building 921). Reference drawing number RF531574.02 and pictures in Appendix B.

3.3.2.4 Remove the Smoke Detection System located on the south panels of the control room horse shoe in Building

921. The Smoke Detection System includes 16 Fireye Model No. 1101 Smoke Detectors and two Leeds and Northrup Speedomax chart recorders. Remove associated wiring to the terminal strip in the rear of the panels and cover the vacant holes in the panels.

3.3.2.5 All material removed shall be taken to the AEDC salvage yard, which is located within two miles of the work site. All items with bar codes shall be turned over the job contact.

3.4. A-Plant North Heater Requirement (Ref. DWG. RU623283.01, Rev. C).

3.4.1. North Heater (10 Main Burners and 10 pilot burners)

3.4.1.1 Burner Management System

Each burner shall use a Honeywell Model No. RM7895C-1012 Relay Module or equal with the following features:

a. Six (6) Minute Purge Timer

b. 57800 Keyboard Display Module

c. C7012 Series Flame Detector

d. R7849B1013 Flame Signal Amplifier

3.4.1.2 The burner relay modules shall be installed in existing Cabinet HTRT located in Building 855 and interconnecting cabling shall be installed between the burner relay modules and the PLC in Cabinet HTRC located in Building 885. Reference Drawing Number RU531717.04 and the pictures in Appendix D. Cabling from the flame scanners, pilot and main burner valves, and ignition systems shall terminate on terminal strips in Cabinet HTRT.

3.4.1.3 Pilot Burners

The pilot burner for each main burner shall be replaced (ten total). Each pilot burner shall:

a. Be capable of replacing the existing pilot burner.

b. Be sufficient length to ignite the main burner.

c. Be capable of handling 30 psig natural gas pressure and igniting the main burner whose natural gas pressure is 30 psig.

d. Have its own ignition system, which will include a 120 VAC primary volt transformer, igniter, and wire(s).

3.4.1.4 Pilot Natural Gas System

3.4.1.4.1 Replace pilot gas supply valves, device numbers NG-SV11-U thru NG-SV20-U, with double block and bleed 120 VAC solenoid valves. ¾ inch NPT. Each solenoid vent valve shall be installed between the double block valves and connected to a vent manifold and piping system as specified in RU623283.01, Rev. C.

3.4.1.4.2. Pilot gas supply to each pilot burner shall include a pressure gauge with isolation valve located downstream and upstream of double block and bleed valves.

3.4.1.4.3. Replace pilot manifold pressure gauges NG-PG3-U, and NG-PG4-U (Reference drawing RU623283.01, Rev. C).

3.4.1.4.4. Provide and replace pilot pressure regulator NG-PRV10-U (Reference drawing RU623283.01, Rev. C).

3.4.1.4.5 Add a branch line off of pilot gas supply down stream of NG-PRV10-U (Ref drawing RU623282.01). The line shall include an isolation valve, pressure gauge, pressure tap for an existing ¼ inch tubed pressure transmitter, low-pressure switch set at 15 inches of water, and a high-pressure switch set at 30 inches of water (See example South

Heater drawing RU623283.02, Rev. B Sheet 3 zone F9 thru 11).

3.4.1.4.6. Add a solenoid valve downstream of NG-PRV10-U and a solenoid vent valve on pilot manifold. (See example South Heater drawing RU623283.02, Rev. B, Sheet 3).

3.4.1.5. Main Burners Natural Gas System

3.4.1.5.1. Replace main gas supply valves, device numbers NG-SV1-U thru NG-SV10-U, with 120 VAC double block and bleed solenoid valves, 2 1/2 inch –150# ANSI raised face flange. Each 1-¼ inch NPT solenoid vent valve shall be installed between the double block valves and connected to a vent manifold and piping system as specified in RU623283.01, Rev. C.

3.4.1.5.2. Main gas supply for each main burner shall include a pressure gauge with isolation valve located downstream and upstream stream of the double block and bleeds valves.

3.4.1.5.3 Provide and replace main gas air operated flow control valve NG-AV1-U. Operation of valve shall be with existing shop air at the valve that varies between 60 and 90 psig. A bypass loop around NG-AV1-U shall be provided with a shut off hand valve and a pressure regulation valve. The pressure regulator valve is to be set at 4 psig with a flow rate 94,800 SCHF. The pressure regulator valve dome to be fed by downstream pressure, and an isolation valve provided in the line. (See example South Heater drawing RU623283.02, Rev. B Sheet 3 zone H8 thru 9 for reference)

3.4.1.5.4. Add a branch line off of main gas supply down stream of NG-AV1-U (Dwg. RU623283.01). The line shall include an

isolation valve, pressure gauge, pressure tap for an existing ¼ inch tubed pressure transmitter, low-pressure switch set at 15 inches of water, and a high-pressure switch set at 35 inches of water (See example South Heater schematic RU623283.02, Rev. B Sheet 3 zone F9 thru 11).

3.5 A-Plant South Heater Requirement (Ref. DWG. RU623283.02)

3.5.1 South Heater (10 Main Burners and 10 pilot burners)

3.51.1 Burner Management System

Each burner shall use a Honeywell Model No. RM7895C-1012 Relay Module or equal with the following features:

a. Six (6) Minute Purge Timer

b. 57800 Keyboard Display Module

c. C7012 Series Flame Detector

d. R7849B1013 Flame Signal Amplifier

3.5.1.2 The burner relay modules shall be installed in existing Cabinet HTRT located in Building 855 and interconnecting cabling shall be installed between the burner relay modules and the PLC in Cabinet HTRC located in Building 885. Reference Drawing Number RU531717.04 and the pictures in Appendix D. Cabling from the flame scanners, pilot and main burner valves, and ignition systems shall terminate on terminal strips in Cabinet HTRT.

3.5.1.3. Pilot Burners

The pilot burner for each main burner shall be replaced (ten total). Each pilot burner shall:

3.5.1.3.1 Be capable of replacing the existing pilot burner.

3.5.1.3.2 Be sufficient length to ignite the main burner.

3.5.1.3.3 Be capable of handling 30 psig natural gas pressure and igniting the main burner whose natural gas pressure is 30 psig.

3.5.1.3.4 Have its own ignition system which will include a 120 VAC primary volt transformer, igniter, and wire(s).

3.5.1.4. Pilot Natural Gas system

3.5.1.4.1. Replace pilot gas supply valves, device numbers NG-SV31-U thru NG-SV40-U and NG-SV51-U thru NG-SV70-U, with 120 VAC actuated solenoid valves, ¾ inch NPT. This installation shall maintain the double block and bleed feature (Reference drawing RU623283.02, Rev. B).

3.5.1.4.2. Pilot gas supply to each pilot burner shall include a pressure gauge with isolation valve located downstream and upstream of double block and bleeds.

3.5.1.4.3. Add pilot manifold pressure gauges upstream and downstream of NG-PRV3-U (Reference drawing RU623283.02, Rev. B).

3.5.1.4.4. Provide and replace pilot pressure regulator NG-PRV3-U (Reference drawing RU623283.02, Rev. B).

3.5.1.4.5. Devices NG-PS1, PS2, PT3, V142, and PG25-NG are to be replaced. The line shall include an isolation valve (NG-V142-NG), pressure gauge NG-PG-25-NG), pressure tap for an existing ¼ inch tubed pressure transmitter (NG-PT3-NG), low pressure switch set at 15 inches of water (NG-PS1-U), and a high pressure switch set at 30 inches of water (NG-PS2-U). The pressure transmitter read out to be in control room (See example South Heater drawing

RU623283.02, Rev. B Sheet 3 zone F9 thru 11).

3.5.1.4.6. Remove manual valves NG-V110-U thru NG-V119-U from vent lines (Ref drawing RU623283.02, Rev. B).

3.5.1.5. Main Natural Gas System

3.5.1.5.1. Replace main gas supply valves, device numbers NG-SV21-U thru NG-SV30-U and NG-SV71-U thru NG-SV80-U, with 120 VAC actuated solenoid valves, 2 1/2 inch –150# ANSI raised flange, with 120 VAC actuation included. The block valves shall have external indication of being in the open or close position. Replace NG-SV41-U thru NG-SV-50-U with 120 VAC solenoid valves, 1 ¼ inch NPT. This installation shall maintain the double block and bleed feature (Reference drawing RU623283.02, Rev. B).

3.5.1.5.2. Remove manual valves, device numbers NG-V75-U thru NG-V79-U and NG-V131, V132, V135, V136, V137-U, on main gas vent lines (Reference drawing RU623283.02, Rev. B).

3.6 C-Plant H1 Heater Requirements (Ref drawing RF631232.01, Rev. A)

3.6.1. Burner Management System

Each burner shall use a Honeywell Model No. RM7895C-1012 Relay Module or equal with the following features:

b. Six (6) Minute Purge Timer

c. 57800 Keyboard Display Module

d. C7012 Series Flame Detector

e. R7849B1013 Flame Signal Amplifier

3.6.2 The burner relay modules shall be installed in existing panel vacated by existing burner controls in Building 921 and

interconnecting cabling shall be installed between the burner relay modules and the H1 Heater Banks 1 and 2 PLC control panel located in Building 921. Reference Drawing Number RF531717.02 and the pictures in Appendices B and E. Cabling from the flame scanners, pilot and main burner valves, and ignition systems shall terminate on terminal strips in rear of existing burner control panels.

3.6.3. Pilot Natural Gas System

3.6.3.1. Pilot gas supply to each pilot burner shall include double block and bleed 120 VAC actuated solenoid valves, ¾ inch NPT, Each solenoid vent valve shall be installed between the double block valves and connected to the existing vent manifold and piping system. Affected area to be from outlet side of manifold valve to pilot burner. All flex hoses shall be reused.

3.6.3.2. Pilot gas supply to each pilot burner shall include a pressure gauge with isolation valve located upstream and downstream of double block and bleeds.

3.7. General Requirements

3.7.1 Contractor shall submit detail piping drawings consisting of device location, electrical connections diagram, combustion safety control diagram, piping flow diagram, piping layout with location and details for each support. Expansion loops and/or offsets shall be used to provide for thermal expansion as required. Existing flex hoses in pilot lines shall be used to provide for thermal expansion. Drawings shall be submitted in both hard copy and electronic form in .dwg format.

3.7.2 The main gas train and pilot gas train shall be pre-assembled to provide interchangeability with compliable gas trains on the north and south heaters. The pilot gas train for the H1 heater shall be pre-assembled and interchangeable with any other pilot gas train on this heater.

3.7.3 All threaded pipe joints shall be made using schedule 80 steel pipe. **NOTE: This is a deviation from the drawings.**

3.7.4 The main gas train and the pilot gas train interface will be at the first valve off of the respective manifold and ends at the burner. This train shall include pressure gauge with isolation valve before the first block valve, solenoid double block and bleed with solenoid vent valve, and pressure gauge with isolation valve between last block valve and burner.

3.7.5 The gas system shall be tested with the methods outlined in NFPA-54.

3.7.6 All carbon steel items (pipe and supports) shall be painted in accordance with AEDC Corrosion Control Plan System No. 3.

3.7.7 All conduit and electrical wiring shall be new and installed in accordance with National Electric Code.

3.7.8 All pipe, nipples, and fittings shall be new. Existing support hardware may be reused at contractor's discrepancy.

3.7.9 All valves, devices, and instrumentation shall be identical and interchangeable with all heaters.

3.7.10 All heater systems shall meet the National Fire Protection Association (NFPA) Standards for Ovens and Furnaces.

3.7.11 All electrical conduits shall be rigid galvanized steel (RGS). Conduits and fittings installed in a Class 1, Division II area shall be explosion proof.

3.7.12 All electrical wiring shall terminate in the termination cabinets located in the perspective heater buildings as shown on drawings RF531574.07 and RU531574.04. Electrical wiring shall be multi-conductor type cable. All wire and cabling shall be marked on each end with a label provided by the contractor before the CDR. The wire/cable number will be provided by AEDC after the CDR. The labels shall be permanently affixed to the cable by the contractor using a Brady labeling machine or similar.

3.7.13 All instrumentation, i.e., pressure gages, etc. shall be acceptance tested prior to installation. Acceptance testing shall be documented and may be performed by the Contractor or AEDC.

3.7.14 Performance requirements are based on current plant support requirements and characteristics of each system. The requirements are summarized separately for each heater system.

3.7.14.1 A-Plant Air Side North and South Heaters

3.7.14.1.1 The system original functionality and requirements shall be maintained. Additionally, the heaters must meet the

National Fire Protection Agency (NFPA) Standards for Ovens and Furnaces.

3.7.14.1.2 Max Capacity: heat 250 pounds air per sec from 100 to 800° F @ 95 psia (each heater).

3.7.14.1.3 Rating: 300 million (10 burners @ 30 million) BTU/Hr – Natural gas @ 20 psig (each heater).

3.7.14.2 C-Plant Air Side Heater H1

3.7.14.2.1. The system original functionality and requirements shall be maintained. Additionally, the heater must meet the National Fire Protection Agency (NFPA) Standards for Ovens and Furnaces.

3.7.14.2.2. Max Capacity: heat 1100 pounds air per sec from 100 to 850° F @ 95 psia.

3.7.14.2.3. Rating: 504 million (12 burners @ 42 million) BTU/Hr Commingled fuel @ 35 psig.

3.7.15 Selection of Materials

3.7.15.1 Materials shall be of a quality, which experience and/or tests have demonstrated to be suitable and dependable for use in heaters. Selection of materials shall be made with special attention being given to the requirements of temperature, vibration, loads, other environmental conditions, reliability, repair ability, and construction.

3.7.15.2 All components of the same size and function shall be interchangeable with each other without the use of any kind of adapters.

3.7.16 Life Cycle/Duty Cycle

3.7.16.1 The A-Plant North and South Heaters Burner Management System, Ultraviolet Flame Detectors, and Gas Train Components shall be designed for 20 years of service based on a usage of 500 to 1000 hours per year with 125 cycles (start/stop) per year.

3.7.16.2 C-Plant Heater H1 Burner Management System and Ultraviolet Flame Detectors shall be designed for 20 years of service based on a usage of 500 to 1000 hours per year with 125 cycles (start/stops) per year.

3.7.17 Reliability

3.7.17.1 The A-Plant North and South heater systems shall have 814 hours Mean Time Between Failure (MTBF).

3.7.17.2 The C-Plant H1 heater system shall have 1179 hours Mean Time Between Failure (MTBF).

Note: MTBF is defined as the total functional life of a population of an item divided by the total number of failures within the population for a particular interval.

3.7.18 Availability

3.7.18.1 A-Plant North and South Heaters shall have 98.8% annual availability. This assumes a uniform, random failure rate over the service life of the system and general downtime.

3.7.18.2 C-Plant Heater H1C-Plant Heater H1 shall have 98.4% annual availability. This assumes a uniform, random failure rate over the service life of the system and general downtime.

Note: Availability is defined as the probability that the system is ready for use when needed. The formula for calculating availability, which considers only corrective maintenance, is A=MTBF/(MTBF + MTTR).

3.7.19 Maintainability

3.7.19.1 The A-Plant North and South heater systems shall have a Mean-Time-To-Repair (MTTR) of 10.0 hours.

3.7.19.2 The C-Plant H1 heater system shall have a Mean-Time-To-Repair (MTTR) of 18.7 hours.

Note: Mean-Time-To-Repair is defined as the sum of corrective maintenance times at any specific level of repair, divided by the total number of failures within an item repaired at that level, during a particular interval under stated conditions.

3.7.20 Environmental Conditions

The system shall operate in ambient conditions from –20 to 120 degree F.

3.7.21 Documentation

The contractor shall provide catalog information for each electrical and mechanical device used. This information shall include as a minimum the manufacturer, model number, size, and rating. The contractor shall include operation and maintenance manuals for all major instruments.

3.7.22 Identification

3.7.22.1 The contractor shall be responsible for tagging all electrical and mechanical devices. Use existing tags for this purpose and fabricate new tags for those that are missing or broken. Device tag numbers shall be provided for new components before CDR.

3.7.22.2 The contractor shall abide by all AEDC Safety, Health, & Environmental Standards & contractor Safety Procedures.

3.7.23 The contractor shall be responsible for coordinating all work with the AEDC job contact, obtaining all permits, work clearances, and outages prior to beginning work.

4 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Inspections shall be performed on items that are representative of those to be delivered under the contract. Except as otherwise specified in the contract, the contractor may use his own, or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of section 3. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the

Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Verification methods. One or more of the verification methods described in this section shall verify all of the requirements of Section 3. If any requirement of Section 3 is not covered by a test procedure in this section, the contractor shall submit a verification procedure using one or more of the verification methods described below.

4.1.2.1 Demonstration - A verification method that is carried out by operation of the equipment, and relies on observable functional operation not requiring the use of elaborate instrumentation or special test equipment.

4.1.2.2 Test - A verification method that is carried out by operation of the equipment and that relies on the collection and prior examination of data.

4.1.2.3 Analysis - A verification method that is carried out by the processing of accumulated data. Analysis shall be carefully documented to ensure that it is specific enough to adequately describe the item in question and that all possible hazards have been addressed without omission or generalization. All calculations shall be specific and logically derived from the presented data. Qualification by similarity shall be limited to comparison with a virtually identical item that has been previously qualified. Qualification difference shall be addressed by engineering analysis showing the effect of the difference on the validity for the current article of the previous qualification results.

4.1.2.4 Inspection - A verification method carried out by visual examination of the equipment or equipment documentation.

Requirements Verification Matrix

Paragraph Number	**Requirement**	*DEMONSTRATION*	*TEST*	*ANALYSIS*	*INSPECTION*
3.4.,3.5.,3.6	Physical Characteristics			**A**	**I**
3.7.10	NFPA Standards				**I**
3.7.14.1.2	A-Plant capacity			**A**	
3.7.14.1..	A-Plant rating			**A**	
3.7.14.2.2	C-plant capacity			**A**	
3.7.14.2.3	C-plant rating			**A**	
3.7.16	Life Cycle/Duty Cycle			**A**	**I**
3.7.17.	Reliability			**A**	**I**
3.7.18.	Availability			**A**	**I**
3.7.19.	Maintainability	**D**		**A**	**I**
3.7.20.	Environmental Conditions	D		A	I

5 PREPARATION FOR DELIVERY

The contractor shall provide all preservation, packing, and packaging to ensure safe delivery of the equipment to AEDC. Ship the equipment to AEDC as completely assembled as feasible so as to minimize assembly work at AEDC. Carefully pack and ship separately any equipment that cannot withstand the hazards of shipment when mounted in place. Identify each such item so they can be readily mounted and connected. The contractor shall provide transportation of all required items to AEDC. Finished surfaces shall be

adequately protected to prevent marring, scratching, rust, and contamination. The contractor shall not use cosmolene as a surface protectant.

6 NOTES

6.1 Glossary of terms

6.1.2 gpm = gallons per minute

6.1.3 psia = pounds per square inch, absolute

6.1.4 psig = pounds per square inch, gage

6.2 List of Acronyms

6.2.2 ANSI = American National Standard Institute

6.2.3 API = American Petroleum Institute

6.2.4 ASME = American Society of Mechanical Engineers

6.2.5 ASTM = American Society for Testing and Materials

6.2.6 ETF = Engine Test Facility MTTR = Mean-Time-To-Repair

6.2.7 MTBF = Mean-Time-Between- Failure

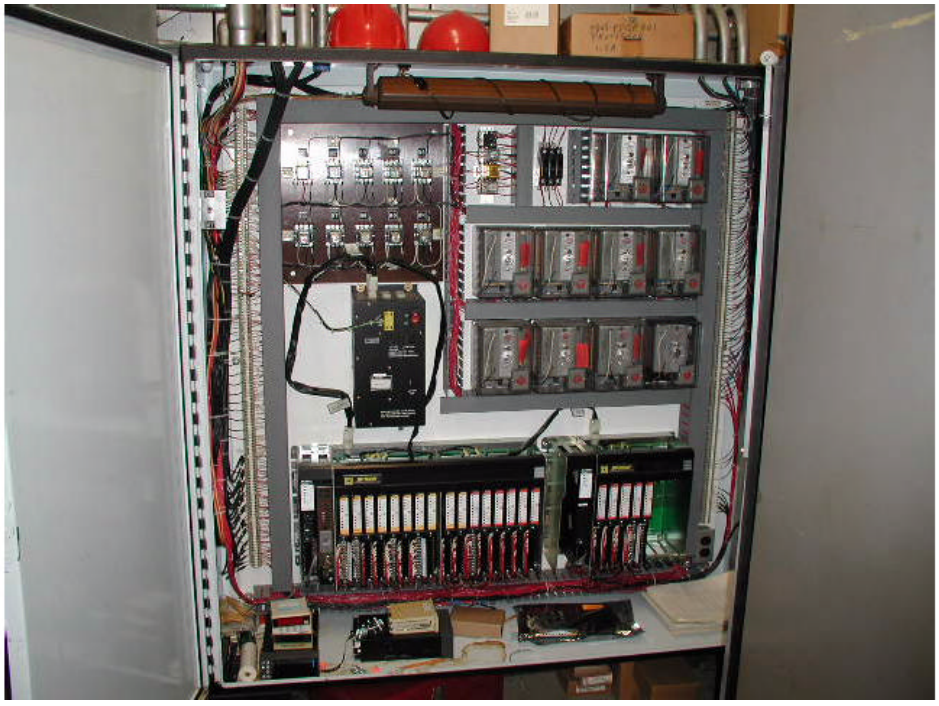
6.2.8 MTTR = Mean-Time-To-Repair

6.2.9 NEC = National Electric Code

6.2.10 NFPA = National Fire Protection Agency

6.2.11 UV = Ultraviolet

7 Appendix A

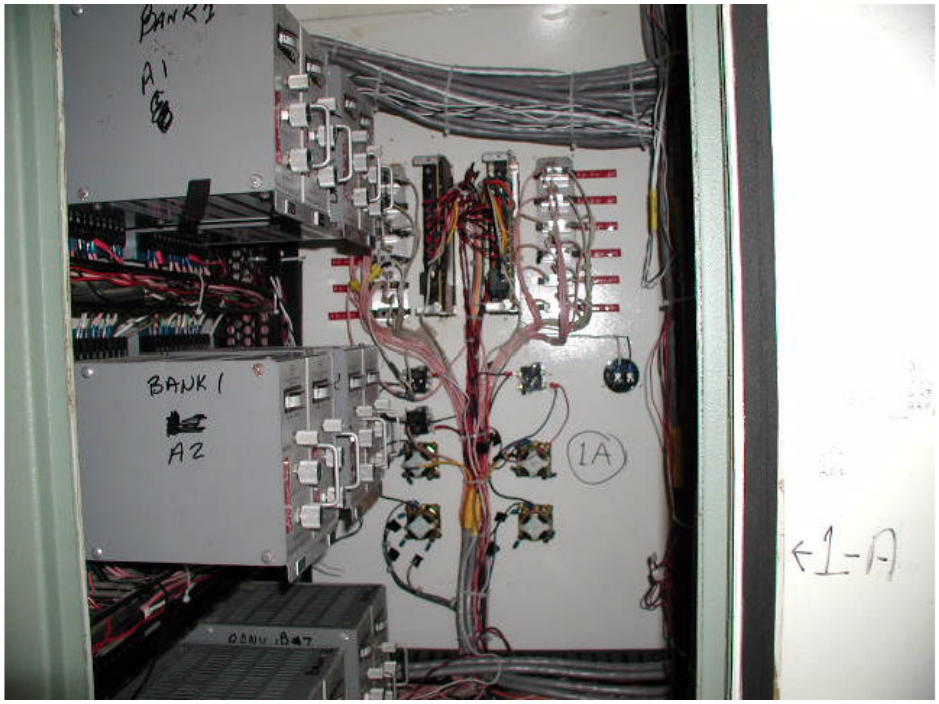


South Heater Burner Management System located in a cabinet on the south wall of Building No. 885. BMS includes ten Fireye Model No. D40-41 controls and Square D PLC.

North Heater Burner Management System (BMS) located on the south wall of Building No. 885. The BMS includes ten Fireye Model No. D40-40 controls.

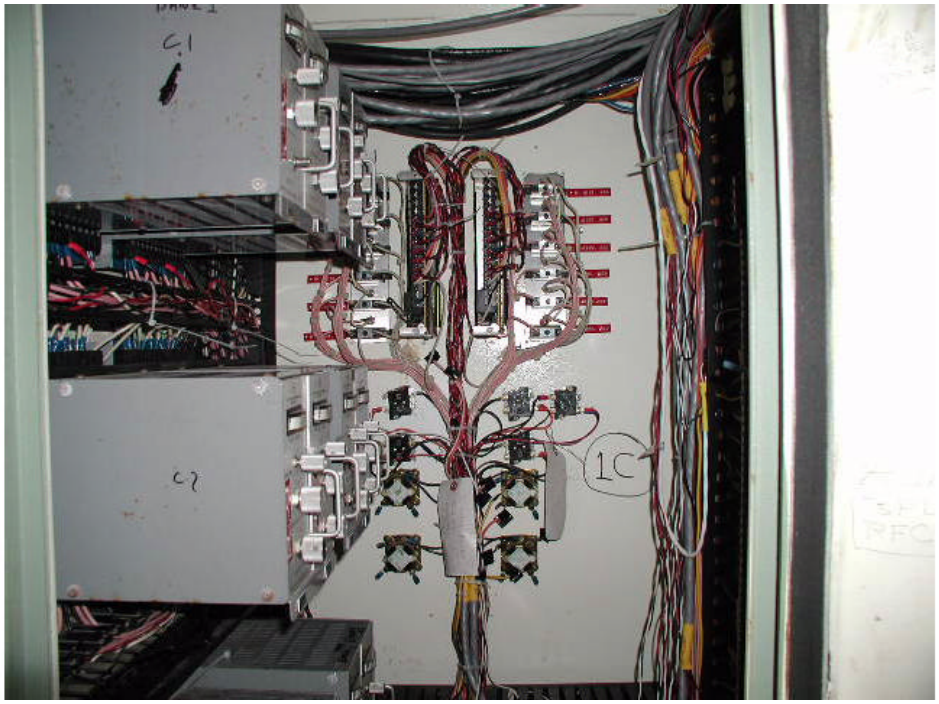
Appendix B

H1 Heater BMS located in Building 921. The A and B Burner control panel on left. The C and D Burner control panel the right.



H1 Heater A and B Burners Fireye Model 25SU3 Flame Signal Amplifier Relay Modules (12 total) installed in rear of A and B Burner control panel.

Appendix C

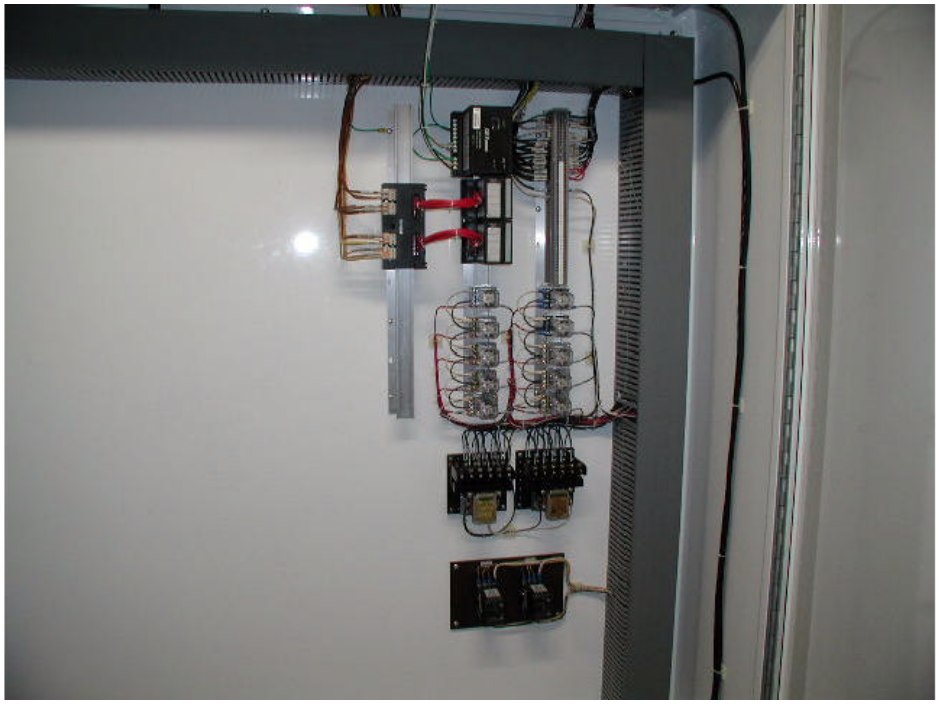


H1 Heater C and D Burners Fireye Model 25SU3 Flame Signal Amplifier Relay Modules (12 total)
install in rear of C and D Burner control panel.

Smoke Detection System includes 16 Fireye Model No. XXXXXX smoke detectors and two Leeds and Northrip Model No. XXXXXXXX chart recorders.

Appendix D

North & South Heaters PLC and I/O panel HTRC located in Building 885.



North & South Heaters termination panel HTRT located in Building 885 to the right of cabinet HTRC.

Appendix E

H1 Heater Banks 1 and 2 PLC control panels located in Building 921.

H1 Heater Banks 1 and 2 PLC termination panel located in Building 921 in rear of PLC panel.